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The Flora of our South-western Archipelago. I.

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Under this very general heading, extended reference will be made to the flora of Guadalupe Island, which though lying far to the south of the Santa Barbara group, and without the territory of the United States, is affected by so many phenomena and conditions identical with those existing upon the more northern islands, that as might be expected the floras of each reveal many features of common interest and, as we expect to show, common relationship.

Speculations as to the origin, development and limitations of insular species enhance in value with the extent of the field under observation. With this end in view casual reference will be made to plants characteristic of islands other than those under direct consideration, but of whose flora our knowledge is still so fragmentary and imperfect, that until exhaustive collections shall have been made therefrom, ultimate conclusions based upon such references must be largely hypothetical and subject to future modifications.

The writer has enjoyed the rare advantage of several visits at different seasons of the year to some of the islands of the Santa Barbara Archipelago; made copious collections and field notes, and had, possibly (thanks to the courtesy of the San Clemente Sheep and Wool Company, and to the principal lessee of Santa Catalina Island), better facilities for the careful and extended observation of their respective floras, than had Messrs. Dall, Gambel, Wallace or Dr. Cooper, who had previously made brief excursions to one or more of these islands.

As for the islands to the south, Prof. Watson's admirable monograph on the "Flora of Guadalupe"[1] and the recent vigorous paper on the same subject by Mr. Greene,[2] together with ample specimens from Guadalupe, Cedros and the adjacent mainland, kindly communicated by the latter gentleman, has supplied me with invaluable material for a fair comparison of the flora of these islands with each other and with the immediate continent.

The general physical conditions existing upon our west coast islands seem to favor rapid and striking modifications in organic life, and if we show this to be the case, then their products afford

[1] Contributions to American Botany by Sereno Watson, Proc. Am. Acad. XI, Feb. 1876.
[2] Studies in Bot. of Cal. and parts adjacent, by Rev. Ed. Lee Greene, in Bull. Calif. Acad. No. IV.

interesting material for the study of the durability and stability of species.

The short interval of ten years between Dr. Palmer's and Mr. Greene's visit to Guadalupe points strongly to the possible extinction of some species, the introduction or genesis of others.

Notably in the cases of Hosackia grandiflora, Juniperus Californica var. osteosperma and Polypodium Scouleri,[3] we apparently have examples of extinction proceeding at a rate sufficiently rapid to bring it within the observation of a single generation of man.

On San Clemente I noted in great profusion the lifeless stem and root of a Cotyledon and can readily credit the statement made to me that only eight years ago the island was fairly carpeted with this plant. A season of drouth drove the sheep to feed upon it, and it is easy to conceive that a succession of better years by affording more wholesome pasture and thus diverting the attention of the stock might enable the species from the few remnants left upon wholly inaccessible rocks to once more regain its pristine supremacy.

A species reduced to the verge of annihilation, or to so critical a condition as the Guadalupe Juniper, might, through a short succession of seasons of ample rainfall, be readily restored to its original vigor.

These somewhat forced illustrations are used to emphasize the fact that on little known islands the utter extinction of species is and will be a difficult matter to establish beyond a doubt. The same remarks apply in reference to the supposition of the recent introduction or creation of new species; some in such abundance now as makes it seem improbable that they should have escaped the keen scrutiny of the expert collector; yet in default of affirmative proof to the contrary, we must ascribe their absence to the first collector's omission rather than to the hypothesis stated.

Though entirely out of order to criticise any part of Mr. Watson's paper at this late day, I can not but express surprise that so conservative an author in drawing his final inferences should lay particular stress upon the absence of certain orders and genera of plants upon Guadalupe.

Due recognition does not seem to have been given to the fact that Dr. Palmer's collections were made in the spring and early summer, and hence (if the flora be at all Californian) would entirely fail to illustrate any of the later flowering Compositæ or Polygonaceæ.

[3] Bull. Cal. l. c., p. 210.

Many species of Eriogonum would scarcely be showing above ground by the end of May. In June, 1884, after a season of unprecedented rainfall and retarded vegetation, I could find no trace of Eriogonum nudum upon Catalina; the same localities revisited in July, 1885, a season of early maturity, showed an abundance only half-grown, and it was not finally obtained in perfection until October, of the same year.

Mr. Greene's discovery of Brodiæa capitata in abundance on Guadalupe conflicts with "the almost entire absence of Liliaceæ",[4] though failing to see any representative of that order upon Mr. Watson's list, the "almost" might have perhaps been altogether suppressed.

That the occasional errors which appear in scientific reports are due to the hasty ill-digested notes of explorers is illustrated in the published accounts of some of these islands.

Dr. Cooper found San Clemente to be "an island with scarcely any soil covering the rocks" * * * * * * "and seems never to have been much resorted to by animals."[5] The first of these propositions is true only of the immediate neighborhood of the usual landing, which is environed by sterile rocks, and at low points along the coast by long reaches of barren sands. The mesas or table lands of the interior, however, show a great extent (many thousands of acres) of fine organic soil of great depth and apparent unbounded fertility. The second proposition is almost as faulty; of marine mammals such as seals, sea lions, etc., it has always, until exterminated, been the favored resort; while the island, since the earliest settlement of the country, has been overrun with field mice and a pretty little gray and red fox, the latter peculiar to the Santa Barbara group, and reported as never having been found on the adjacent mainland.

The absence of soil would imply the absence of much vegetation, combined with absence of animals it would imply a country almost unfitted to sustain organic life, and convey to the average mind a desert or howling wilderness, instead of a land of promise capable with water development of great possibilities. The same authority reports the existence of "one good spring of water upon Catalina," another statement which, though undoubtedly true, is hardly comprehensive enough, as after a season of unusual drouth (1885), the writer noted forty-two springs, streams, wells or different sources of water upon that island.

In comparing the floras of these islands with each other and

[4] Proc. Am. Acad. l. c. p. 3.

[5] Geology of California.—Vol. I. p. 183.

with Guadulupe, a brief geographical sketch of the principal islands of the Santa Barbara archipelago seems unavoidable.

Santa Catalina lies a little southwest of the shipping port of San Pedro, Los Angeles county, Cal., distant about twenty miles. Clemente has nearly the same bearings from San Pedro, and is some fifty miles distant. These islands as respectively named, are about twenty and twenty-two miles long with varying widths of three to eight miles. Both lie nearly northeast and southwest, and in shore line conform generally to the trend of the coast at Santa Barbara. Both are of volcanic origin; Catalina showing not only extensive lava masses but a well defined crater, and probably, like Guadalupe, was the result of one subterranean upheaval or disturbance.

Like that island, it is traversed for its length, excepting only at the isthmus near the west end, by a lofty and terribly precipitous mountain chain which, branching occasionally, makes place for several large, fertile, well-wooded and well-watered valleys.

Clemente is unquestionably the product of many upheavals, proven by the succession of terraces extending for its whole contour. The fact that the sea along the line of its former tide levels has not only smoothed and worn the faces of these adamantine basalt terraces, but mined great caves in them, is sufficient evidence to assume vast lapses of time between some of these disturbances. This porphyry formation, overlaid with a great depth of soil where shown by the excavations made by Indians when walling in their villages or walling out the winds, together with the terrace formations is enough to justify us in claiming for this island an antiquity far greater than either Catalina or Guadalupe. If this be true, then we might reasonably expect to there find a flora more distinctively peculiar than that pertaining to either of the other two islands. Such is not the case, however, and the geology of the island apparently is not verified by the botany as we now find it. Whether this apparent antagonism is real or fictitious, and due, and to what extent, to modifications arising from artificial or external causes, we will endeavor later to determine. As in Guadalupe, ice and snow are not of rare occurrence in the mountain valleys of Catalina, although the lesser elevation of Clemente probably exempts it from these phenomena.

Neither of the northern islands show any signs of the tropical vegetation (Erythæa) obtained in Guadalupe.

Lying more in the lee of islands to the north (Santa Cruz, Anacapa and Santa Barbara), the channel which separates Santa Catalina from the mainland is always smooth and pacific, save in the rare instance of the southeast gales, and from that island's

greater proximity and readier accessibility to the mainland, as might be expected, it shows a larger preponderance of continental forms of vegetation than exist on either of the others.

The outward channel to Clemente is often boisterous in the extreme; and the long, unbroken surges of the Pacific give the squeamish traveler in a small boat the full flavor of a protracted sea voyage.

Nearly identical climatic conditions prevail on all three; cooler in winter than the mainland, hotter and drier in summer on the south sides, owing to the deflection of the cooling fogs by the mountain tops.

The prevailing winds and ocean currents are similar to those affecting Guadalupe, and whose nature and influence has been so clearly and ably set forth by Mr. Watson, that I can not do otherwise than refer for the details to his admirable paper.[6] Therein he shows the nature of our prevailing winds are in every way antagonistic to the introduction of continental species to Guadalupe; curiously he seems to have overlooked the converse of this proposition, which would be that this agency would actively favor the distribution of insular species to the mainland.

Whilst recognizing as a factor, I am of opinion that the value attached by authors to the common media of seed transmission, *i. e.*, agency of man, beasts, birds, watery currents and winds, is somewhat over-estimated; the history of our island plants tends to confirm and strengthen this belief.

1. The case of *Malacothrix insularis* Greene, and *Lavatera insularis* Wats. confined to the Coronados Isles, though only distant seven miles from the mainland.

2. The limitation of at least three well-defined species to Cedros,[7] which with the island of Natiridad forms the western barrier of San Sebastian bay, Lower California, and whose topography would seem to indicate that at no distant epoch they formed a continuous part of the mainland.

3. A new species of Pentachæta, found originally near San Pedro in the spring of 1884 and confined to the area of a few square yards, was the following year traced to its original habitat on Catalina Island. The spot where found on the mainland has been for twenty-five years past constantly used for pasturing

[6] Proc. Am. Acad. l. c., p. 107.

[7] Veatchia Cedrosensis, Œnothera Cedrosensis and Senecio Cedrosensis.

No account is taken of *Krynitzkia Cedrosensis* Greene, less on account of its doubtful specific value than from the fact that apparently confluent forms have been collected on the mainland; but the whole genus is regretfully excluded from our consideration; the burr like character of the fruit makes it peculiarly available for artificial distribution and the establishment of a well-defined species so near the mainland, yet limited to the island, would be a potent argument in behalf of the opinion expressed.

sheep just disembarked from that island, and the case cited is probably as direct evidence of the agency of animals in seed distribution as any that could be quoted: nevertheless, with every circumstance conspiring during very many years to favor its introduction in manifold, the total "crop" of 1884 might readily have been the product of one fertile akene growing and maturing the previous year!

4. Prunus occidentalis is a species which, from its abundance, gives character to the vegetation in parts of Catalina. Its great size (25 feet) and conspicuous beauty seem to preclude the possibility of its having escaped the notice of the most unobservant explorers of islands to the north or south, and it is probably safe to assume its confinement to this island alone of all on our western coast, yet it is reported to me as native of the West Indies. The abundance of young and flourishing seedlings indicate that it germinates readily; while its large and luscious drupe greedily fed upon by squirrels, sheep, goats, birds and man would seem to provoke its widespread and rapid distribution. It grows far up on the roughest interior mountain ridges at an elevation of 3,000 feet, and down the fertile valleys and cañons to the very water's edge; at all altitudes and all exposures it flourishes with unequaled vigor, yet no trace of it exists on Bird Island, barely two miles distant.[8]

5. A somewhat analagous case is that of the Lavateras. This genus is largely represented on most of our western islands, from Anacapa on the north to San Benito, Lower California, on the south, with probably no congener on the mainland other than escapes from gardens where it has been largely planted. Yet the genus is indigenous to the south of Europe and adjacent islands: that it should owe its presence in the occident to the common methods of seed dispersion and leave no trace upon intervening continents is somewhat improbable: that it is due to systematic transplantation upon uninhabited islands is more than improbable —it is an unreasonable supposition.

That a great ocean is not an insurmountable barrier to the migration of species is a fact commonly known. A single Asiatic species of Castilleia illustrates it; yet that genus sweeps along the whole western coast of North and South America, from Arctic to Antarctic zones, and the chances have weighed heavily in its favor of finding an outlet from some of its myriad sources: no such conditions, however, obtain in the case of the Lavatera or

[8] For the benefit of botanists who have not seen it I wish to say that P. occidentalis is a most beautiful tree whose symmetrical form, glossy coriaceous leaves and white flowers approximates in appearance an orange tree, and in some valleys it forms unique plantations every way comparable to an orange grove.

still more restricted Prunus. That the physical conditions surrounding our island plants are extremely favorable for the rapid development, perfection, retrogression and perhaps ultimate extinction of new species, certain observations of their habits tend to show.

Of plants or species found conjointly upon the islands and mainland, the island forms are inclined to vary. The variation the most uniform and striking of all is in the preponderance of giant growths.

Brodiæa capitata on Guadalupe, though restricted in area, was of such great size as to elicit surprise from Mr. Greene that it should have escaped the notice of his predecessor, Dr. Palmer. The same plant on Clemente, also within narrow limits, showed the same immense habit. Mr. Watson unqualifiedly referred it to B. capitata, only noting immense size and a trifling difference in the stamens, not enough to justify varietal rank. Its absence from Catalina, apparent absence from Guadalupe only ten years ago, and scarcity on Clemente, induces me to think that not only is it of recent introduction from the mainland, where in many localities its abundance gives character to the spring vegetation, but that it is even now in a transitional state. That the presence of identical physical conditions should elaborate similar forms on even widely sundered islands, is not improbable; hence, to quote the ideas, if not the words of the distinguished author of "Plant Variations," it is not difficult to believe, that on each island, within a few plant generations, we may witness the outgrowth of a distinctively new type, sprung from a common stock, but different individuals, and varying from the parents with similar variations. This hypothesis would cover the case of the Prunus (the genus being continental), provided we could show co-existence at some past time of like conditions upon Catalina and its present West Indies habitat.

I revert once more to the genus Lavatera as showing not only abnormal development of island species, but illustrating the facility of some species to become exhausted or extinct when palpably uninfluenced by any other than strictly natural causes.

It is commonly known that very many plants, with skillful manipulation, "improve" under cultivation; *i. e.*, at least increase the size of flower and leaf. This is anything but the case with Lavatera assurgentiflora, which I collected on Clemente from larger plants, in finer foliage and greater size and brilliancy of flower than anything observed in gardens. Its introduction into cultivation, and from having become occasionally spontaneous

upon the mainland, must forever be a bar to its complete extirpation; yet the *natural* tendency of the species I think we can show to be on the decline or toward extinction. Sealers report that once abundant upon Anacapa and San Nicolas, it is now scarce; on Clemente, it was only observed in two localities, and only one or two plants in each; yet only a dozen years ago it constituted unbroken forest, extending for miles upon the high plateaus. Extraneous causes alone are not sufficient to account for its disappearance; the few luxuriant specimens left are readily accessible to sheep and goats, and their ravages unsupported will not explain away its manifest decadence.

No trace of it is found on Catalina Island, and Bird Island, a rugged, rocky islet not two miles distant, carries it in some profusion. The latter island is not used for grazing stock, while Catalina is; yet a resident on that island before the first sheep or goat was introduced, thoroughly familiar with the plant, and for whose close observant power I have the highest respect, assures me that he has never seen a single plant within its limits.

Of other plants having mainland representatives, and whose heroic size arrest attention, we may briefly mention Solanum Xanti, var. Wallacei—a rank growing form.

Of Ceanothus sorediatus, from Catalina, Dr. Gray says, "never saw it before in such large leaf and fruit."[9] On the southern mainland a straggling shrub of 12 to rarely 15 feet; here it becomes a tree of 25 feet.

Our common Convolvulus occidentalis of the mainland becomes the well defined *C. macrostegius* Greene, although in elaborating the species he lays no especial stress upon its size.

Elymus condensatus in rich damp soils is not infrequently 6 feet or more upon the mainland; in dry sterile places on Catalina it overtops a tall man on horseback.

The genus Eriogonum which we readily recognize by its preponderance of tiny forms and slender, delicate habits of growth, confounds all our preconceived ideas by developing into immense arborescent species upon the islands. *E. arborescens* Greene of Santa Cruz I have not seen, but from name and description it presents a marked difference from anything continental. *E. giganteum* Wats. shows a contrast still more striking, outstripping in heroic dimensions anything yet known in the genus. Not rarely a bush 10 feet in height and the same diameter, uniformly topped with its magnificent cream-colored cymes eighteen inches

[9] In a letter.

in diameter, it forms one of the most beautiful and interesting features of our island flora.

Prunus illicifolius Walp. on our coast range mountains a small leaved, straggling shrub; on Catalina becomes a stately tree of 50 feet with leaves 2½ inches long.

Audibertia polystachya of abnormal size occurs on Catalina, and current with it A. Palmeri, common also to Guadalupe; the readiness of the genus to commingle and hybridize might lead us to anticipate under insular influences many modifications; none, however, were noted except in that of size.

The genus Rhus may be mentioned here as not only the genus of plants more than any other which from its abundance of individuals and species gives character to the vegetation of the island, but as might be expected shows a tendency to vary if not noticeably in size, at least in a manner not observed upon the mainland.

R. integrifolia was collected with very many ternate leaves, but in all other respects strictly identical with the normal type; observed in two widely diverse localities and in profusion. This form possesses great interest as marking perhaps the initial steps to subsequent specific modifications.

Leptosyne gigantea, another large type of probably strictly insular origin, is rapidly disappearing from at least the northern islands. The liking of man and beast for its succulent foliage as "greens" and "pasture" may account for its reported collection on the mainland, where it may obtain a stable footing, otherwise it must sooner or later have fallen within the great catalogue of unnamed ephemeral species which have once flourished, been modified, fallen into decadence or disappeared forever.

Examples could be multiplied, but the list as given is sufficient to show the activity of physical conditions upon these islands in the production of ultra vigorous vegetable growth. Further it should not be forgotten that the collections upon which these notes are based were made in a season of unparalleled drouth, when the collection of depauperate specimens upon the mainland was the rule, a season so adverse to the development of abnormal luxuriance in vegetation that the fruits of many species for the collection of which I especially revisited Catalina in October of last year, failed to mature seeds of germinative power.

Cont. p. 330.

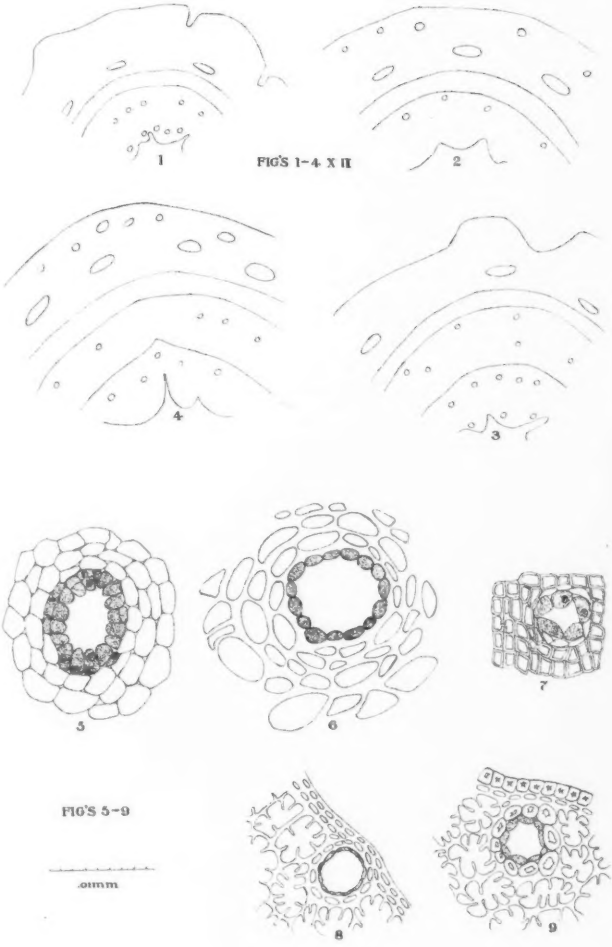
Structure and distribution of Resin Passages of the White Pine.*

ETTA L. KNOWLES.

WITH PLATE VII.

First a study was made of the general structure of the stem and leaf of the white pine (*Pinus Strobus*) with reference to both the relation and structure of different parts. The Scotch pine was studied in the same way and afterwards a comparison made between the two. Stems of one and two years growth were taken of each species and put into alcohol for the purpose of removing resin, and the material thus preserved was ready for use as needed. Leaves of each and young shoots cut at intervals of a few days were treated in the same way. Thin sections were cut, stained with Schulze's Solution and mounted in glycerine. For each point studied sections were taken of a dozen or more different stems. Drawings and measurements were all made with the camera. Upon comparing stems of the two species it was found that the general appearance is much the same, pith at the center and formed about it in successive rings, wood, cambium, phloem, cortex and epidermis, the main difference being that in the Scotch pine there is but one row of resin passages in the cortex and two rows in each year's growth in the wood, while in the white pine there are two rows or rings in the cortex and one row in each year's growth in the wood. In the cortex of the white pine the number of resin passages was found in some instances to be as high as 47 in a stem of one year's growth, while in the Scotch pine 9 or 10 seemed to be the limit. Figures 1, Scotch pine, and 2, white pine, show the distribution and arrangement of the resin passages in the two species in stems of one year's growth; figs. 3, Scotch pine, and 4, white pine, show the same for stems of two years' growth. Taking stems of the two species of as nearly the same diameter as possible, it was found that in the cortex of white pine stems of one year's growth the number of resin passages ranged from 20 to 47, the average being about 33. The number in the wood was more uniform and averaged about 13, giving an average of about 46 in a stem of one year's growth in white pine. In the Scotch pine the average for the wood was found to be 33 and for cortex 10, or about 43 for both wood and cortex. In the Scotch pine one ring is irregular in outline and lies just within the wood surrounding the pith, as seen in figs. 1 and 3. The average

*Selected for publication from original work of students in the botanical laboratory of the University of Michigan, 1885-'86.



KNOWLES ON RESIN PASSAGES.

number for this ring was found to be 18. Taking the second year's growth in the same way the average number for cortex of white pine is 28 and for wood 27, or 55 for wood and cortex. Scotch pine for cortex 9 and for wood 37, or 46 for wood and cortex. From this it will be seen that the number of resin passages varies greatly with the individual as well as with the species.

Shoots of present year's growth taken from the tree at intervals of a few days, from April 30 to May 30, showed little change except in the increased growth of the woody portion. In the cortex there were found as high as 47 resin passages, the average being 38, but no traces of them could be seen in the wood. In shoots taken from the tree June 21, the woody portion had united to form a ring and two resin passages were found, one apparently just formed and still in the cambium, just at the line where wood and cambium meet. It was much larger than mature resin passages in the wood, the growth of the parts around not having compressed it. Resin passages in the wood of the white pine do not begin to form until about the last of June.

Resin passages in the cortex of the young shoot of the white pine are cylindrical and have no walls of their own, being bounded simply by the surrounding cells, which are all thin-walled. Fig. 5 represents a passage found in a shoot cut from the tree May 6. As the stem grows, the tube, small at first, may become larger by division of the cells adjoining it. After a time it becomes lined with thin-walled epithelium, the cells of which project into its cavity, the walls of the cells outside the epithelium thicken and by the pressure of the parts about it as the stem grows, the larger passages are pressed into an elliptical form as seen in cross sections. It is at last, then, a cylindrical or flattened cylindrical passage lined with thin-walled epithelium, which is surrounded by a layer or more of thick-walled cells.

A large resin passage is situated opposite each vascular bundle, while the passages near the epidermis are much smaller. From May 6th (fig. 5) up to May 30th there was little change observed, but by June 21st the passages in the cortex seemed to be nearly or quite developed, looking very much as is shown in a passage from a stem of a year's growth, fig. 6, the walls of the surrounding cells having become very thick.

The structure of the resin passages in the wood is different from that in the bark. They are much smaller. There is the same lining of epithelium, surrounded in this case by one layer of thin-walled cells, which come in contact with the tracheides, the layers of the thick-walled cells being wanting.

Comparing the resin passages in the leaves of the two species

the number for the comparatively tender and delicate leaf of the white pine was found to be from 2 to 3; the number in the Scotch pine from 5 to 8. They are nearer the surface in the leaf of the white pine, fig. 8, than they are in the leaf of the Scotch pine, fig. 9, the bounding cells in the former coming in contact with the epidermal cells.

The structure seems to more closely resemble that of the passage in the cortex than of that in the wood. There is the same lining of epithelium, very thin-walled, and the surrounding thick-walled cells, one layer in the case of the leaf, the surrounding layer being thicker in the leaf of the Scotch pine than in that of the white pine. The cells lining the resin passages of cortex, wood and leaf, form resin which they afterward pour into this canal. The cells surrounding the epithelium were found to contain a large amount of starch. The walls of these surrounding cells seemed to be thicker before growth started in the spring than afterward, sections cut from the tree in February showing thicker walled cells than those cut in April or May.

Notes on Campanula Medium.

BOLLING W. BARTON.

The plant upon which observations were made does not correspond satisfactorily with figures or description of this species, but I am assured by the best authority that it is nevertheless Campanula Medium. Only a single plant was under notice, and already many of its flowers had so far passed that the determination of several details of conduct of promising interest had to be deferred.

The flowers in question are of a delicate pink or rose color. The corolla tube is about 1¼ inches in length and ¾ inch wide at the mouth, and is not spreading like those of most of the genus, but is more cylindrical, being slightly constricted about halfway down the tube. The inside of the tube is entirely destitute of hairs. Reflexed lobes from between the sepals quite conceal the ovary. The flowers are uniformly erect and not horizontal or drooping, as is characteristic of many species. This character holds good until the corolla withers, when it may incline somewhat to one side. For the rest the structure is essentially like that of other species of Campanula, the peculiarities being the expanded base of the filaments fitting over the ovary and the linear introrse anthers, which lose their pollen on the hairy style as the flower unfolds, a good example of proterandy. Attention

was directed to this plant by seeing in one of its flowers a large dipterous insect vainly trying to climb up its walls. After failing in this it turned to the hairy style, up which it climbed with ease, and over the stigma and took flight. The interpretation of these movements were simple enough, if they were shown to be constant. An insect visiting the flower for the nectar in the bottom of the corolla and not being able to escape by reason of the smooth corolla, except by climbing the style and over the stigma, and the plant being proterandous, cross-fertilization becomes almost inevitable. To test the matter further, especially as regarded the slipperiness of the corolla tube, the following experiments were made: A number of insects of different shapes and species were put into the flowers and their actions carefully observed. The first one tried was a small cricket, which was handled so as not to wound it, and was dropped into the flower. It at once began to struggle to get out, but failed to make the slightest headway, its feet taking no effect whatever, so far as could be seen with a pocket-glass, upon the corolla wall. It was left in this situation but was found to have escaped some hours later—probably by climbing the style or by a well directed jump.

The next thing tried was a medium-sized bumble bee (probably Andrena), which I had knocked off a flower and slightly stunned, but which had recovered sufficiently to crawl freely and even to use its wings. The most that this bee could do towards getting out when put into the flower was to turn about and raise its head, and so standing on end, its back to the style, clawed impotently against the corolla tube until wearied out. It was then left alone for an hour, when being touched with a straw it began again its struggles, with no better success than at first. After that it was turned around so as to face the style, when it easily climbed up and escaped.

A spider was the next subject and proved itself just as unable to climb the corolla as the others preceeding. It succeeded in getting out at last by resting one of its long legs against the style and working another one over the rim of the corolla and so drawing itself to the top of the cup.

I next made use of a small grasshopper, which also entirely failed to take any hold upon the corolla wall, and after imprisonment for some minutes succeeded in making its escape by jumping out.

Finally a house-fly was caught, and having had both wings carefully clipped with scissors was dropped into the flower. The result in this case was beyond expectation of those who witnessed

the experiment, notwithstanding what had gone before. The acrobatic, glass-walking fly was just as impotent in its attempts to walk up the wall of the flower as had been the other insects experimented with. In a very short time, however, the fly discovered the easy exit by the style, and after a few lessons would turn to this means of escape without loss of time. Six times in quick succession did it come up by the style and was then allowed to crawl away.

During the performance of these experiments a number of small ants were running over these same smooth walls as if they had been sanded, and also several visitors in the shape of small diptera flew in and out and crawled wherever fancy led them without difficulty. But at no time did I see one of these ants or flies ascend the style. The ants were evidently in search of nectar, and from the caravan lines which had been established in and out of some of the flowers there is little doubt but that they were getting a fair supply.

In the books are to be found the following references to the cross-fertilization of Campanula Medium. Sir John Lubbock says "Insects visiting the flower for the sake of honey do not so far as I have observed generally walk on the petals, being deterred by the stiff hairs which are scattered on their inner surface. In any case, however, they are almost sure sooner or later to clasp the style when they necessarily dust themselves with pollen." Herman Müller has nothing bearing directly upon Campanula Medium. Delpino remarks that "In the large flowers of Campanula Medium I have almost always found some species of Cetonia, which probably is the insect best adapted to fertilize this plant."

The first large insect seen in the flower was clearly unable to fly out, the space between the style and corolla wall not being sufficient to allow for the spread of the wings; still more would this difficulty hold for one of the Cetonias mentioned by Delpino. But by climbing the style and on to the stigma the place of vantage would be reached from which the wing covers could be raised and flight made easy.

As regards the visits of the ants it was noticed that very soon after fertilization of the flowers a certain relaxation of the parts followed, and the ants could then without much trouble work their way into the chamber under the expanded filaments, in which is secreted the nectar. But in the newly opened flower this chamber is effectively closed against any small insects. To test the efficiency of the roof made by these filaments against rain the experiment was made of shaving off the ovary with a razor, leav-

ing the upper wall so as not to disturb the relations of the base of the corolla and the filaments. Then with a small, sharp blade cut out from below the remaining upper wall of the ovary, taking care to clip off the style and leave it in place to fill the angular space which would otherwise be left. Having done this nothing is left to stop the lumen of the corolla tube but these filaments. If water be now dropped into the corolla it will be found to hold perfectly.

How any considerable quantity of rain which might fall into these upright flowers could get out again remains to be found out. But it is not unlikely that it will be found that when a certain quantity of water does collect, either by its weight it will bend the flower over and escape or by its presence may excite some auxotonic movement causing the flower to nod and dump it out.

A repetition of these experiments should of course be made upon newly opened flowers and upon the particular variety here described.

Botanizing in Texas.* II.

J. REVERCHON.

In this locality (House Mts.) two entirely new plants were discovered, and both have been decorated with the name of Reverchoni, a Diplachne and a Campanula. The latter is a little annual, making long ribbons of the finest blue in the cracks of the rocks, with here and there a large tuft of Cereus pectinatus all ablaze with its beautiful pink blossoms, or a picturesque cluster of Cereus paucispinus covered with brick-red flowers. The more noted plants collected here were: on the side of the mountain, Metastelma Palmeri, Zexmenia hispida, Cyclanthera dissecta, Ipomœa Lindheimeri; on the banks of a sandy creek, Astragalus leptocaulis, and a variety of Mentzelia Wrightii with very small flowers.

From House Mt. to Mason is a region mostly sandy or rocky, in which three rare plants were collected: Panicum ciliatissimum, Brazoria truncata, and Polypteris Hookeriana. Juglans rupestris began to appear along the rocky banks of streams.

At Mason, a little German town, we resumed our westward march. The soil is generally poor, sandy or gravelly, up the Llano valley, the plain being covered with mesquit brush. At a

*Continued from March, 1886, p. 59.

distance and on both sides of the valley is a continuous line of bold bluffs overlooking the plain. Excepting near the river, and an occasional grove of post-oak, the ligneous vegetation is scant and dwarf. The last sign of granitic formation was left in Mason county, and in reaching Kimball all the rocks are limestone. Here for the first time we met the Sophora speciosa, already in fruit, the red beans of which are considered very poisonous. In fact these beans, scattered over the rocks, seem to be respected by every kind of animal. Near our camp on the Little Saline creek we made a good collection: in the valley, Tetrodes Coulteri, Berlandiera lyrata, Parthenium lyratum, Gaura macrocarpa, Aristolochia brevipes, Coldenia canescens, and Croton Neo-Mexicanum; on the neighboring bluffs, Schœnocaulon Drummondii, Lepidium lasiocarpum, Abutilon parvulum, Styrax platanifolia, Perezia runcinata, Chrysactinia Mexicana, Hymenatherum tenuilobum, Atriplex canescens, and Leucæna setosa, the last being a remarkably fine shrub. There also occurred two Yuccas, Y. canaliculata, growing to the height of 9 or 10 feet and giving to the landscape a tropical appearance, the other, referred to Y. rupicola, though I think it is different.

Along the Big Saline creek we noticed for the first time since we left Dallas the Quercus Muhlenbergii; but afterwards we find this species quite abundant in the mountainous region of S. W. Texas.

The 16th of May we reached Junction City, where the two forks of the Llano river unite. We pitched our tent on the north fork, in a beautiful spot, and if we were not botanizing I would have much to say about the delicious fish, the squirrels, the beavers, etc. The river is full of Nuphar advena, and near a picturesque fall I collected Lythrum ovalifolium and Agrostis verticillata. In the thicket covered valley I notice the following species: Callirrhoe pedata, Antirrhinum maurandioides, Vesicaria Gordoni, Stillingia Torreyana; on the rocky bluffs, Specularia Lindheimeri, Allionia incarnata, Nicotiana trigonophylla, Notholæna sinuata, and a beautiful Cereus unknown to me. At the foot of a perpendicular rock near the river I found Euphorbia chamesula, and a grass new to science, Festuca Texana.

The north fork of the Llano is fringed with a growth of fine timber, but the high bluffs, which come closer to the river as we ascend the valley, are covered with bushes or stunted trees, Quercus Durandii making most of the thickets. Very often these bluffs are covered with high walls of hard limestone of dazzling whiteness.

On the 21st we arrived at old Fort Terrett, which is situated

at the headwaters of the North Llano. All the neigboring hills are densely covered with mountain cedars (Juniperus occidentalis, var. conjungens). A few plants were collected along the roads, such as Rivina lævis, Pentstemon Jamesii, and Nama Jamaicense, but nothing different from what we had found below.

West of Fort Terrett we found ourselves on a vast table land, the divide between Devil's river to the west and the Nueces to the south. This country is a perfect desert, with only temporary supplies of water in holes, plenty of grasses though not properly a prairie, being covered with mesquit bush, clumps of post-oak, and thickets of cedars and live oaks, the home of the peccary, or Mexican hog. The cretaceous rocks crop out in every direction, and traveling in a wagon through such a country is nothing but punishment. Here the curly mesquit grass (Hilaria cenchroides) abounds, and low and rich spots were perfect masses of the orange colored flowers of Coreopsis cardaminæfolia. We also observed for the first time Hoffmanseggia brachycarpa, Thelypodium linearifolium, Actinella odorata, one of the commonest plants on the plains of W. Texas, and Erodium cicutarium, but this last I am satisfied was introduced through the agency of transient sheep.

We were detained a whole week at Mackenzie Well, on the head of South Llano. The country is the same as the divide, but I had more leisure for collecting. The following are some of the most interesting plants: on the rocky knolls, Erythræa calycosa, Abutilon holosericeum, Encelia calva, Zexmenia hispida, and two ferns, Pellæa flexuosa and Notholæna sinuata; in lower places, Chamæsaracha coronopus, Aristolochia brevipes, Dalea rubescens, Abutilon Wrightii and parvula, Argythamnia Neo-Mexicana, and a new variety of Sporobolus asperifolius, called brevifolius by Dr. Vasey. On the banks of Mackenzie Lake was found Zapania cuneifolia, var. angustissima.

I collected there many other plants that occur in other western localities, such as Siphonoglossa pillosella, Aristida Reverchoni, Passiflora tenuiloba, and Boerhaavia viscosa.

At Mackenzie Well we were convinced of the futility of trying to reach the San Pedro, or Devil's river, or even the Nueces, by the divide, for the trails were nothing but piles of rocks, over which our wagon would not have lived three days. Reluctantly, therefore, we took a trail going back to Junction City by the South Llano. We found along this river about the same vegetation as before, but two remarkable plants of this region deserve mention. One is Nolina Texana, whose long leaves are used for thatching Mexican huts, the other the Sotol (Dasylirion Texanum), of which I will speak more hereafter.

At Junction City we took the Bandera road, going up Johnson's creek, where I had the pleasure of collecting for the first time the beautiful Macrosiphonia Berlandieri, and Galphimia angustifolia. A grass, Hilaria mutica, quite abundant on the plains of W. Texas, was found there, being the only locality where I observed it in all our trip. I must not fail to mention the aljorita bush (Berberis trifoliata), very abundant in these regions, and whose berries, either raw or cooked, are really good. The Mexicans and settlers use them extensively.

From the headwaters of Johnson's creek to the head of Guadalupe river, there is a mesa or table land of about 20 miles, where the vegetation is similar to that of the divide, and on which the only new plant found was the magnificent Ipomœa leptophylla. I noticed in a common Texan plant (Œnothera serrulata, var. spinulosa), whose flowers in the north and west are uniformly yellow, that here the stigmas were jet black, while a little further south the throat of the corolla also shared in this striking color.

The 3d of June we reached the Guadalupe, and the vegetation began to change. In the valley, Tetragonotheca Texana, Berlandiera Texana, Pentstemon Wrightii (mostly in seed); on the rocky bluffs, Eupatorium ageratifolium and Ptelea angustifolia (in fruit); on the banks of the river, Aspidium patens, and, in rocky shades, Asplenium parvulum.

The next day there appeared along the river the beautiful Sabine (Taxodium distichum). Afterwards we observed this tree along most of the rivers in the mountainous region north-west of San Antonio. Between Kerrville and Bandera the country is mountainous, covered with good grasses but not very interesting to the botanist, the only plants collected being Euphorbia angusta and Psoralea cyphocalyx. It is well to notice that the Psoralea bearing that name in Curtis's distribution is a new species, *P. Reverchoni* Watson.

The 6th we camped at Bandera's Pass, a very interesting place to the botanist. On both sides of the road are two high and very steep hills, up whose rocky sides I undertook to climb. My time and labor were not lost, for I found, first at the foot, a very coarse grass, Epicampes distichophylla; next in the rocks, Nolina Lindheimeriana; higher up, Prunus copallina, Fendlera rupicola, Rhus cotinoides (all in fruit); in the cedar breaks at the top, Onosmodium Bejariense (in seed), Streptanthus bracteatus, Verbesina Wrightii; and on exposed flat rocks, the graceful Erythrea calycosa, var. nana.

In nearing Bandera the live oaks grow to an enormous size,

and were covered with Tillandsia recurvata. We crossed the Medina at Bandera, where our only discovery was Amorpha lævigata, and took a westerly direction over what was called by the inhabitants a "good mountain road." Afterwards we understood the meaning of "mountain road." Soon we were in a very rough country, which we have good reason to believe no botanist ever visited. In fact, no one will ever visit it, who has any care for his limbs or neck. Of course in such a country progress was slow, and the 10th of April finds us camped on the banks of a fine stream, whose clear waters were dashing madly among the rocks. All around were hills clad with shrubbery and covered with overhanging rocks. We were in the wilderness and enjoyed it. It would be more than ungrateful not to pay a tribute to the great pile of dainty perch and fine trout lying before our camp fire. Beginning along the rivers, in swampy places are found several northern plants, such as Schoenus nigricans, Eleocharis rostellata, and Selaginella apus, mixed with Dichronema leucocephala and Reverchoni, Buchnera elongata, a variety of Samolus ebracteatus, and Epipactis gigantea; among the rocks, at the foot-hills, Asclepias perennis, Aspidocarpa hyssopifolia, Keerlia effusa, Cassia Lindheimeriana; on the top rocks, abundance of Laphamia Lindheimeri. A good many interesting shrubs are found here, Salvia ballotæflora, Budleia racemosa, Philadelphus serpyllifolia, Garrya Lindheimeri, Arbustus Xalapense, var. Texense, the last three in fruit. The last named species is called *Madrona* by the Indians, a small tree, very peculiar and picturesque in appearance. As for the ferns, near the water were Adiantum Capillus-Veneris, and Aspidium patens; amidst the rocky shades, Pellæa flexuosa, Cheilanthes Alabamensis, and Asplenium parvulum. But what made me forget all my falls and bruises was the discovery of the rare Aneima Mexicana, growing everywhere in the shade, and the rarest Pellæa aspera, found on exposed rocks!

At last we were out, emerging from the Sabinal cañon, and camped on that beautiful stream. Our principal finds are Capsicum baccatum, Salvia Rœmeriana, Acalypha hederacea, Russellia tuberosa, var. occidentalis (or, as I think, a good species), Bernardina myricæfolia, Cordia podocephola, Polygala ovalifolia, Indigofera Lindheimeriana, Euphorbia villifera and acuta, Melochia pyramidata, Triodia eragrostoidea, Muhlenbergia calamagrostoides, Setaria setosa, Chaptalia nutans, a new Petalostemon (P. luteolus Wats.), and a fern, Notholæna candida, the only one found on the rocky banks of the Sabinal. One plant deserves special mention, the beautiful Amoreuxia Wrightii. The pec-

caries are very fond of its roots. On the sandy plains below the cañon we find Dalea pogonathera, Cevallia sinuata, Menodora longiflora, Leucophyllum Texanum, Mimosa Berlandieri, and Lindheimeri; in the richest part of the prairie, Eupatorium Greggii and Desmanthus reticulatus.

Near the Sabinal cañon is the small cañon of Blanco, in which a curious cave has recently been discovered. Of course this new wonder had to be visited, and on our way we admired the gigantic *sotol* (Dasylirion Texanum) in all its glory. It is used in Mexico, as the Agave, to make an intoxicating liquor, and the bases of the leaves, that look like monstrous artichokes, are considered delicious vegetables, but we did not touch them. Here we added to our collection such plants as Heteropogon contortus, Fallugia paradoxa, Jatropha spathulata, and Mirabilis Jalapa.

Thus far we had had a tolerably pleasant time, in spite of gnats, mosquitoes, and other insects, but the dry weather had now set in, the heat was increasing alarmingly, the water was sinking very fast into the sandy beds of the rivers, and, what was more important to me, the vegetation was beginning to shrivel up and disappear. Our team was jaded, our provisions consumed, our clothes in tatters, our finances exhausted. We had either to refit our expedition or retreat, hence after consultation, the march on Mexico was postponed and a retreat ordered.

Uvalde was the most south-western point visited by our expedition, where we found Malvastrum tricuspidatum. Along the Frio, nearly dry all the way, were found Aristolochia longifolia and Oxalis dichondræfolia, and two fine shrubs, Anisacanthus Wrightii and Chilopsis saligna.

The homeward journey began the 20th of June. Between Uvalde and Castroville is an extensive plain, covered with thickets of mesquit, Acacia Rœmeriana, A. Wrightii, but the most common is certainly A. Berlandieri. There was also Condalia obovata, Celtis nitida, Scheifferia cuneifolia, Diospyros Texana. Among the herbaceous plants were Dianthera parvifolia, Perezia Wrightii, Sanvitalia ocymoides, Helianthus ciliaris, and Jatropha Berlandieri. On the banks of the Seco we gathered Marsilia macropoda, Neptunia pubescens, and Synedrella vialis. We noticed also, climbing on the mesquit, the singular Ephedra pedunculata, but with neither flower nor fruit.

For the most part the vegetation along the return route was similar to that we had met earlier in coming out, and towards the last of July we reached home.

BRIEFER ARTICLES.

Notes on Arisæma triphyllum.—Last year I called attention in the GAZETTE to some striking variations in Arisæma triphyllum, and knowing that I should have the opportunity of being where the two kinds might be found, I hoped that some other observer would be drawn to examine whether the differences were associated with its sexual characteristics, or were really such as to mark a distinct variety. It so happened that I found myself where they were abundantly in bloom, and the notes seem worth recording. In the one case are leaves pale green above and glaucous beneath. In the other the leaves are thin and look green on both sides. On this occasion I found them in large numbers, and both forms growing together. Many of them seemed intermediate, and it was difficult to decide to which section they belonged. A large bundle was collected, taking care to gather them pretty much as they ran. There was no trouble in selecting the two extremes, and these, when selected, looked very distinct. These, and the intermediates, made the three sets. Then it was seen that the wholly green-leaved ones were mostly very vigorous, the stems in some instances being half an inch thick, and they had rarely any but female flowers—an occasional male flower only among the hundreds of females. Those with the gray under surface were mostly males, and the plants small—the stems rarely thicker than a lead pencil. Only in rare instances were females present, and these but very few in the spathes, where they were found at all. In the intermediates only were the monœcious forms found, and in all these females preponderated,—indeed, the male flowers in these cases were always largely in the minority. The species is, in fact, so far as this locality, near Philadelphia, is concerned, almost wholly diœcious. I think the pollen in these technically monœcious flowers can be of little service, and the plants must be practically uni-sexual. In a half day of wandering through the wood, no insect was seen among the flowers, nor could any trace be found indicating their visits. The structure of the spathe is not favorable to the reception of much pollen through the aid of the wind, though the pollen structure would indicate an anemophilous class. What the plant gains by this division of the sexes, in any effort to secure cross-fertilization, is difficult to determine. Indeed, fertilization of any kind must be rare, for seldom have I been able to find specimens with fruit in this district. But the species has been well able to distribute itself, for it is found over a wide area. The spathes vary from a pale green to a brown purple. The stems also show a diversity of color. This has no sexual significance—the same varying shades being found in the three separate sets. Indeed, in the strong plants with the wholly female flowers, the capitate stigma, with its innumerable minute capillaries, would sometimes be of a beautiful rose, while in other spathes they would be wholly white. The texture and shades of the leaves seem to have relation to sex—but not so with color.—THOMAS MEEHAN.

CURRENT LITERATURE.

Contributions to American Botany. By Sereno Watson. Proc. Amer. Acad. xxi. 414–468. Issued June 2, 1886.

This is Dr. Watson's thirteenth contribution and, as usual, is full of new species. The first part contains a list of plants collected by Dr. Palmer in Mexico, in 1885. The second part is devoted to the descriptions of new species, chiefly from the Pacific States and Northern Mexico. We specially note a new Canbya, from Oregon; Silene Hallii, a new Rocky Mountain species, distinguished from S. Scouleri, and about 20 new Leguminosæ.

The third part begins a series of notes upon a collection made by Dr. Watson himself, in Guatemala, in the spring of 1885. The fourth and last part contains some notes upon a few palms of Guatemala, most of the 25 species collected being still undetermined, A new species, Bactris Cohune, is described. It is a palm six to fifteen feet high, is abundant in the Chocon forests, and is called by the natives "Warree Cohune." Mr. Watson always adds to the convenience of his papers by appending a complete index.

Flora of the Yellowstone National Park. By Frank Tweedy. Washington, D. C. 1886. pp. 78.

This is an excellent catalogue of the vascular plants of one of our most interesting regions, and visited as it is by so many hundreds of tourists each year, this catalogue must be in considerable demand as a guide to the location of plants. The author has brought together all the plants reported, and from this small area, 55×65 miles, 657 species are listed. It is noticeable that while the Compositæ (108) and Gramineæ (72) are, as usual, the ranking families, the Cyperaceæ drop to the sixth place with but 26 species. Before them come Scrophulariaceæ (32), Leguminosæ (28), and Ranunculaceæ (27). The very interesting collection of grasses, made by Mr. Tweedy, is being described in this journal.

Contributions to American Botany. By Asa Gray. Proc. Amer. Acad., xxi. 363–413. Issued May 4, 1886.

This is the twenty-third number of these contributions, and by far its most important part is the revision of North American Ranunculi. This genus was hastily compiled nearly half a century ago for Torrey & Gray's Flora, with very little knowledge of original material, and has now come up again for study in preparation for Gray's Synoptical Flora. Naturally the work has been a difficult one, and we now have this genus really for the first time thoroughly presented to American botanists. Including Greenland, we have 59 species, grouped under six sections, the last of which (*Euranunculus* Gray) contains 49 species. The first section is the old *Batrachium* DC., with four species; the fourth is *Cyrtorhyncha* Gray, while the others are established for the first time. A section, *Oxygraphis*, is made of the Asiatic genus Oxygraphis, of Bunge, and introduced after Batrachium, but it is yet uncertain that it contains any American forms. *Pseudaphanostemma* and *Crymodes* are other sections, while *Halodes* is represented in our flora by the widely diffused R. Cymbalaria. Some three or four new species are included, and many new varieties. The polymorphous *R. occidentalis* Nutt., is made to include *R. Nelsonii* Gray, and five of its extreme forms are described as varieties. *R. hispidus* Michx., partly, DC., Hook, is disentangled from R. Pennsylvanicus, etc., and set up as a good species, with the somewhat composite authority quoted above.

The botany of Northern Mexico, cultivated by Mr. Pringle, continues to yield an astonishing harvest of rare and new species, many of which are described in this contribution, and among them are to be found a new genus of Compositæ (Piptothrix), near to Eupatorium, and a revision of the North American species of Metastelma.

Contributions to the history of certain species of Conifers. By Dr. Maxwell T. Masters. From Linnean Society's Journal, vol. xxii. pp. 169-212. plates II-X.

This is a collection of notes and plates, and is meant to furnish the basis of a fuller sketch of the family. Coming from such hands, however, it would be strange if it did not contain valuable material. The American species discussed are *Abies amabilis* Forbes, *A. grandis* Lindl. (with vars. Lowiana and pallida, the latter equaling *A. concolor* Engelm., partly), *A. concolor* Lindl., *A. subalpina* Engelm., and *A. nobilis* Lindl. (with new vars. glauca and magnifica, the latter equaling *A. magnifica* Murray). There has arisen much confusion concerning some of our species, and anything that can be said to bring us to a clearer understanding of them will be welcomed. It is refreshing to see the variety of characters used, and also the reliance that is being placed in the anatomical structure of the leaf. When gross and minute anatomy join forces in descriptive botany some good work will be the result.

A Manual of Structural Botany. By M. C. Cook, M. A., LL. D. W. H. Allen & Co., London. J. H. Vail & Co., New York. 1884. 16mo. pp. iv, 123.

Twenty-five years ago this little volume was prepared to meet the demand for a cheap manual. For one shilling it gave all the salient facts belonging to structural botany, not professing to round out the periods or popularize the dry details. It was to be considered more as a reminder than as an instructor. Now at this late date a new edition has been issued, said to be thoroughly revised. The growing need for cheap books in all departments of science should be recognized and we turned hopefully to this to represent botany. We are sorry to find that while it may have done very well a quarter of a century ago it is no nearer than that to the present status of botany. The last twenty-five years in botany means a good deal, and to say that a botany is published which takes no account of that interval, is to say that it is about worthless. The book before us deals in the most antiquated ideas and terms. Scores of words are used which have been long ago banished to the limbo of useless nomenclature. Besides this, mistakes are more numerous than they should be. On p. 18 is the description and figure of "raphides," the former of which applies to crystals in general, and the latter represents the compound crystals of Begonia. Parenchyma is said to be cellular tissue with cells hexagonal in cross-section. "When a spiral line is coiled up in the interior of cells, it is called *Fibro-cellular* tissue." It furthermore states that this spiral is sometimes broken up into bars and forms elongated dots. "Pleurenchyma" is said to be "glandular woody tissue," all of which seems to refer to the discigerous tissue of conifers. One of the cell contents is the "*primordial utricle* or *protoplasm*." The pith of a stem is said to be composed of "cellular tissue" as opposed to the woody parts, while the "bark" is treated in the style of long ago. The pollen tubes are said to "penetrate the ovules and discharge into them the contents of the pollen grains, and thus a union is effected between the fovilla, or fertilizing principle of the pollen, and the semi-fluid contents of the ovule." But enough of such illustrations. In many parts the definition of the fixed anatomical terms would serve the purpose of a glossary. The real truth is, the book is untimely. If one understands botany, this book is not needed; if he wants to learn it, this is very far from being the book he wants.

NOTES AND NEWS.

LACTUCA SCARIOLA has been found this season by Mr. Rose, in Union county, Indiana.

THE GLUTINOUS RICE of Siam (Oryza glutinosa) has starch which gives a red or red-brown coloration with iodine, instead of blue. It does not appear to differ otherwise from ordinary starch.

REV. KARL KALCHBRENNER, a prominent mycologist, died June 5, at Wallendorf, Upper Hungary, 80 years old.

IN THE JULY *American Journal of Science* Dr. Gray gives a memorial sketch of the late Professor Edward Tuckerman.

M. ED. BORNET, the eminent algologist, has been elected member of the French Academy of Sciences as successor to M. Tulasne.

THE FOURTH FASICLE of Millspaugh's American Medicinal Plants has just appeared. For its purpose, it is a very elaborate and complete work.

DR. A. GRAVIS has been appointed professor in the University and director of the Botanic Garden at Liége in place of the late Professor Morren.

IT IS REPORTED that Dr. Bowdeswell, of England, has discovered the germ of hydrophobia to be a micrococcus found in the nerve tissues. His paper upon the subject is looked forward to with interest.

PROFESSOR TRELEASE has discovered Eurotium Aspergillus-glaucus upon opium. The announcement, with description and plate, appears as a Contrib. Dep. Pharmacy of the University of Wisconsin for 1886, II, 5-9.

IN THE *West American Scientist* for June, two new cactuses are described, one of them being figured. They are published from the manuscript notes of Dr. Engelmann. One is an Echinocactus and the other a Cereus, both from Lower California.

IN THE JULY *Journal of Botany* some Japanese desmids are described and figured, while W. B. Grove continues his papers upon new or noteworthy fungi. Mr. C. C. Babington begins a paper upon the British Rubi, a very large and most puzzling group.

IN THE JULY NUMBER of the *Journal of Microscopy* (London) Mr. R. H. Moore describes the structure of Anagallis arvensis, with the aid of three plates. In the same number Mr. H. W. S. Worsley-Benison presents a very interesting *resume* of the subject of plant movement.

IN THE *American Naturalist* for July, Dr. Byron D. Halsted describes and figures some curious pollen-tubes of Lobelia syphilitica. They were distorted and misshapen in a strange way, but the cause could not be discovered. The tubes were naturally formed, artificial cultures not having been tried.

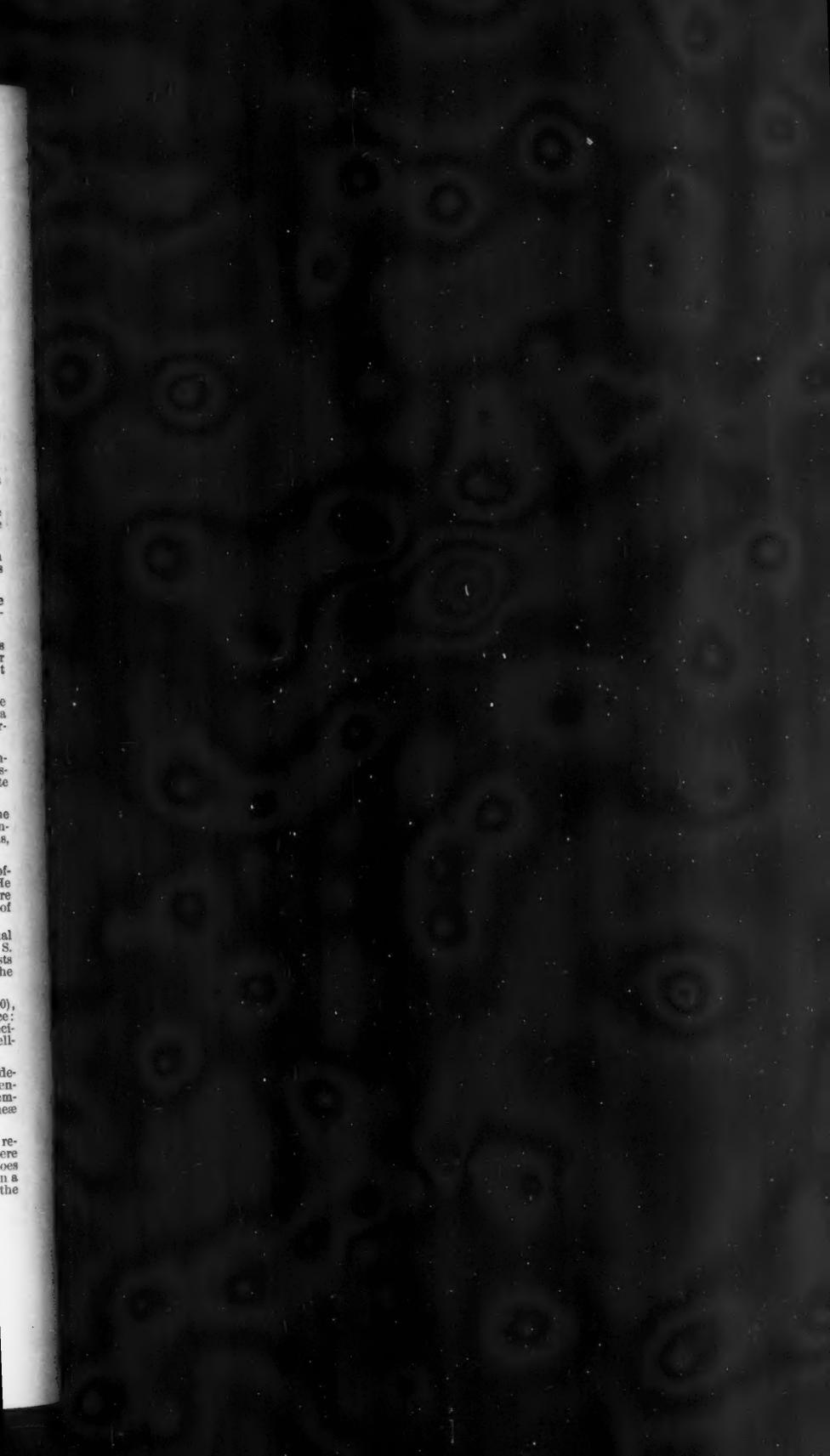
WE LEARN from *Nature* that the Swedish Academy of Sciences has issued a work entitled "The Correspondence of Carl von Linnaeus," containing a record of all the correspondents of this famous naturalist, Swedish as well as foreign, with their addresses, date of birth and death, etc., as well as the date of each letter to and from.

PROF. S. M. TRACY, of the Missouri State University, has published a catalogue of the vascular plants of that state. It is the first attempt at a complete catalogue, but it contains 1,785 species. The state is said to be divided into four well defined botanical regions, viz: (1) bottom lands; (2) swamp lands; (3) Ozark region; (4) prairie region.

DR. T. MILLMAN, of Kingston, Canada, writes of finding specimens of Taraxacum officinale with two scapes blended into one and bearing two complete heads of flowers. He also finds the same thing in Chrysanthemum leucanthemum. Last year dandelions were found in Crawfordsville with three scapes blended into one and bearing three heads of flowers.

THE SOCIETY for the Promotion of Agricultural Science, holds its seventh annual meeting in Buffalo, August 16 and 17, the two days preceding the meeting of the A. A. A. S. The meeting promises to be a full one and rich in papers. Several of our best botanists have forwarded the titles of papers to be read. Dr. B. D. Halsted, of Ames, Iowa, is the Secretary.

TO DR. GRAY'S note upon the arillus in Asimina (BOTANICAL GAZETTE, July, p. 190), should be appended the following, received too late for insertion in its proper place: Asimina angustifolia, of which Mr. Curtiss has now sent both *flowering* and fruiting specimens collected in July, has the ovate-subglobose seeds of A. pygmæa and an equally well-developed arillus.

DR. C. C. PARRY has published in the Proc. Davenport Acad. Sci., Vol. v, p. 26, the description of a new genus of Eriogoneæ, from Lower California. It is founded upon Bentham's Pterostegia macroptera and Greene's P. fruticosa. The name, *Harfordia*, commemorates a well-known Californian botanist. The genus is remarakable among Eriogoneæ for its dicœcious flowers, and differs from Pterostegia in its perennial habit.

STRASBURGER has been experimenting upon intergrafting and has reached some remarkable results. Among herbaceous Solanaceæ, Datura, Tobacco, Henbane, etc., were grafted successfully upon the common potato. In the case of the Datura graft the potatoes were impregnated with atropine. It is said that Tschudy long ago grafted tomato upon a potato stock, and "gathered potatoes from the bottom and tomatoes from the tops of the same plant."